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Strength measurements using an isokinetic dynamometer and functional evaluations in patients with soft-tissue sarcoma of the thigh who underwent knee flexor muscle resection

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Background and Purposes:

In some cases of soft-tissue thigh sarcoma, knee flexors such as the hamstring are resected. However, the extent to which knee flexion decreases after resection of knee flexors and the extent to which this decrease in strength affects postoperative function is currently unclear. The purposes of this study were to use an isokinetic dynamometer to measure post-resection knee flexion strength and retrospectively examine its correlation with postoperative function.

Patients and Methods:

We retrospectively reviewed the records of 12 patients with deep-seated soft-tissue sarcoma of the thigh who had undergone wide resection of the knee flexor muscles between 1991 and 2014. The exclusion criteria were superficial site of involvement and patient death, terminal illness, or chemotherapy at the time of the investigation. The median age of the six women and six men was 64 years (range, 42-87), while the median observation period was 56.7 months (range, 12-277 months). The patients' resected muscles were examined; knee flexion strength was then measured using the Biodex System 4 isokinetic dynamometer and evaluated by the ratio of the affected to the unaffected limb. Postoperative function was assessed for affected limb function, activities of daily living, and quality of life using the Musculoskeletal Tumor Society (MSTS) score, Toronto Extremity Salvage Score (TESS), and Euroqol (EQ5D) questionnaire, respectively. Statistical processing was conducted using Pearson correlation coefficient, and the significance level was set at less than 5%.

Results:

The median decrease in muscle flexion strength was 72.5%. Median MSTS score, TESS, and EQ5D values were 93.3%, 95.4%, and 0.79, respectively. In all of the above, low flexion strength corresponded with low scores (MSTS score; $r=0.90$, $p<0.001$ / TESS; $r=0.88$, $p<0.001$ / EQ5D; $r=0.75$, $p=0.005$). Individual case analysis revealed slight decreases in flexion strength in one case in which the sartorius, another case in which the gracilis, and one in which both these muscles were resected (97.8%, 95.4%, and 86.1%, respectively). In the three cases of medial hamstring (semitendinosus, semimembranosus) resection and three cases of lateral hamstring (biceps femoris, long head and short head) resection, median flexion strength was 76.2% and 66.1%, respectively. In the one case of mediolateral hamstring and gracilis resection, flexion strength was 45.7%. In the two cases of mediolateral hamstring and sciatic nerve resection, flexion strength measurements were 18.0% and 0%. Postoperative function was low in the two cases of sciatic nerve resection, with MSTS scores of 30% and 33% and TESS of 42.6% and 50%. However, the remaining 10 cases had favorable MSTS scores and TESS > 80%.

Conclusion:

Although postoperative function decreased in conjunction with flexion strength, functionality was considered satisfactory if 40–50% flexion strength was retained. On individual case analysis, patients who underwent resection of the sartorius or gracilis muscle alone demonstrated almost no flexion strength decrease but favorable postoperative function. Lateral hamstring resection further reduced flexion strength than medial hamstring resection. Furthermore, combined mediolateral hamstring resection greatly reduced flexion strength. Nevertheless, all patients who underwent hamstring resection demonstrated satisfactory postoperative function. Conversely, patients who underwent sciatic nerve resection demonstrated markedly attenuated flexion strength and poor postoperative function. Thus, even in cases of resection of both the mediolateral hamstrings, the muscles most responsible for knee flexion, postoperative function can be preserved as long as the sciatic nerve remains intact. The limitation of this study includes a small sample size. It is difficult to assess postoperative function in soft-tissue sarcoma cases due to the infrequency of its onset, scarcity of similar cases, and the difference in resection area for each case. In the future, there is a need to increase our sample size for further analysis.